



Canada's National Laboratory for Particle and Nuclear Physics
Laboratoire national canadien pour la recherche en physique nucléaire
et en physique des particules

August 14, 2009

Hon. James Rajotte, M.P.
Chair, Standing Committee on Finance
6-14 131 Queen Street
House of Commons
Ottawa, ON K1A 0A6

Dear Chairman Rajotte and Colleagues,

Thank you for this opportunity to contribute our thoughts to the House of Commons Standing Committee on Finance's pre-budget consultation process. As explained below, we believe that TRIUMF can play a critical role in creating a brighter economic future, improving healthcare for Canadians, and attracting global talent to and retaining it in Canada.

Executive Summary

TRIUMF is located on the south campus of the University of British Columbia and owned and operated by a consortium of 15 universities stretching from Halifax to Victoria. As Canada's national laboratory for particle and nuclear physics, TRIUMF derives nearly all of its science and technology programs from accelerators. This international laboratory tackles the most compelling questions in particle physics, nuclear physics, nuclear medicine, and materials science. TRIUMF is a bridge from basic research to commercialization and economic growth; it is a driving force for innovation and commercialization that affects the economy, healthcare, and the environment. TRIUMF stimulated nearly \$1 billion of economic activity in the last decade.

TRIUMF's operations are supported through a contribution via National Research Council Canada in five-year funding increments. TRIUMF's five-year planning process has identified targeted opportunities that are ripe for exploitation: they build on TRIUMF's successes, play to Canadian strengths, and promise high-impact results. The three chief elements of the 2010-2015 plan are:

- Building a new superconducting electron accelerator for discovering and generating new heavy isotopes for nuclear physics and medicine;
- Providing leadership in the ground-breaking field of nuclear medicine; and
- Participating fully in the international Large Hadron Collider project at the European Organization for Nuclear Research (CERN), Switzerland.

All three initiatives have potential for significant scientific, economic, and societal impact. For instance, TRIUMF researchers are working on solutions to the medical-isotope crisis as well as new technologies that will diversify and supplant the current dependency on a single type of isotope.

The funds sought from the Government of Canada (in addition to a recent Canada Foundation for Innovation award amounting to \$23 million) to fulfill this vision are \$305 million over five years. This funding will renew and expand the present cycle of investment which completes in 2010.

Introduction

As a national laboratory, TRIUMF provides research infrastructure and tools that are too large and complex for a single university to build, operate, or maintain.¹ Its mission is:

- To make discoveries that address the most compelling questions in particle physics, nuclear physics, nuclear medicine, and materials science;
- To act as Canada's steward for the advancement of particle accelerators and detection technologies; and
- To transfer knowledge, train highly skilled personnel, and commercialize research for the economic, social, environmental, and health benefit of all Canadians.

TRIUMF has evolved into an internationally renowned laboratory with strong ties to the research programs of Canadian universities (nearly 75% of all NSERC research awards in subatomic physics involve TRIUMF). Initially founded by three western universities, the consortium has grown to 15 members (two new members in the past year) and spans from sea to sea. The TRIUMF science program has similarly expanded from nuclear physics to include particle physics, molecular and materials science, and nuclear medicine. Over 350 scientists, engineers, and staff perform research at TRIUMF. Every year, the laboratory attracts over 500 national and international researchers, and provides advanced research facilities and opportunities to 150 students and post-doctoral fellows.

The bulk of TRIUMF's operating support is awarded from the Government of Canada in five-year cycles through a contribution agreement via National Research Council Canada. The present performance period completes in 2010; together with the Canadian physics community, TRIUMF has developed an ambitious and compelling plan for the 2010-2015 period.² Its goals are:

- Substantially expand TRIUMF's rare-isotope beam program;
- Lead the coming revolution in nuclear medicine;
- Expand Canadian access to international science and technology;
- Pursue advanced accelerator technologies;
- Exploit targeted opportunities for commercialization with partners such as Advanced Applied Physics Solutions, Inc., D-Pace, PAVAC, MDS Nordion, and GE Healthcare; and
- Train the next generation of leaders in Canadian science, technology, and innovation.

To illustrate the crucial role that TRIUMF plays in Canadian research and innovation excellence, consider the field of nuclear medicine and the present crisis in the supply of critical medical isotopes (*e.g.*, Molybdenum-99 or Mo-99). As a national laboratory with expertise in the physics, chemistry, and biology of isotopes for nuclear medicine, TRIUMF is actively engaged in multiple efforts to develop and deploy solutions. These efforts are rooted in research; bring in academic and industrial partners; and seek breakthrough discoveries, innovations, and commercial-ready products.

- For the short-term, under the framework of the NSERC/CIHR medical-isotope research funding announcement, partners such as BC Cancer Agency are working with TRIUMF to benchmark a technique for using present-day cyclotrons to produce Mo-99 in current medical-imaging centres. A number of alternative isotopes will also be examined.

¹For more information, please see TRIUMF's website at URL <http://www.triumf.ca>.

²TRIUMF's Five-Year Plan is online at URL <http://www.triumf.ca/about-triumf/message-director/five-year-plan>.

- For the medium term, TRIUMF is developing Zero-Enriched Uranium Mo-99 (ZEUM) technology as an add-on to its existing physics and accelerator programs (submitted to the Natural Resources Canada Expert Panel on Medical-Isotope Production). Employing next-generation accelerator technology rather than nuclear reactors—and using natural rather than weapons-grade uranium—ZEUM can be used to supplement or wholly supply Canada’s domestic needs for isotopes. ZEUM technology integrates easily with the present-day supply chain in terms of business, distribution, product handling, and regulation. The outcome of this project would be a technology ready for licensing, a business plan for private-sector deployment of ZEUM technology in Canada, and published peer-reviewed scientific results.
- For the long term, TRIUMF is working with partners across Canada to deploy and expand the emerging technology of PET (using accelerators known as cyclotrons) which will supplant and then replace Molybdenum-99 over the course of a decade.³

Canada can be proud of TRIUMF and its 40 year history of scientific achievement. TRIUMF is a critical component of the national infrastructure for science and technology. Consider the recommendation of the International Peer Review Committee, a group of distinguished experts in science, business, and healthcare convened by National Research Council Canada to review TRIUMF’s performance and future plans. The Committee wrote:

The Plan presents an exceptional opportunity for the Canadian scientific and business communities to seize world leadership in the two main thrusts of the proposal [next-generation accelerators and nuclear medicine]. It is fully aligned with Canada’s Science and Technology Strategy and strengthens all three advantages: entrepreneurial advantage, knowledge advantage, people advantage. Consequently, the Review Committee wholeheartedly and unanimously endorses the proposed Plan in its totality. Failure to support either the scientific thrust or the level of funding, as proposed in the Plan, would jeopardize this opportunity irreversibly.

Economic and Social Impacts

MMK Consulting was retained in late 2008 to develop estimates of the total economic impacts estimated to be generated through TRIUMF’s Five-Year Plan. In addition to full funding of TRIUMF, MMK’s analysis accounted for the impact of the associated capital infrastructure request to the Province of British Columbia (\$60.7M in new buildings and conventional facilities).⁴

Inclusive of direct, indirect, and induced impacts, it is estimated that TRIUMF will generate \$912 million in provincial output, \$511 million in provincial GDP, \$50 million in provincial tax revenues, and 1,284 FTE jobs over the coming five years. These impacts are in addition to construction jobs that will be created by facility expansion. It is estimated that 179 person-years of construction employment will be created between 2010 and 2013, with 71 FTE jobs being created by 2011. These estimates do not include economic impacts arising from breakthrough discoveries and knowledge creation from TRIUMF science and technology programs over the five-year period.

³Although there are presently only about 20 PET imaging systems in Canada compared to the more than 2,000 systems based on Mo-99/Tc-99m-style technology, the use of PET imaging continues to grow (last year, by more than 7%).

⁴“Economic and Social Impacts of TRIUMF,” MMK Consulting, February 2009.

Alignment with Canada's Science and Technology Strategy

TRIUMF's Five-Year Plan is well aligned with Canada's priorities outlined in *Mobilizing Science and Technology to Canada's Advantage*, released in 2007.

Knowledge Advantage: Global Excellence in Research and International Partnerships

TRIUMF is one of the leading laboratories in the world for studying rare isotopes, and in some instances is the best. These rare isotopes will be the medical isotopes of the future for advanced cancer imaging and targeted therapy. Investment worldwide in this rare-isotope research will exceed \$4 billion in the next decade. These discoveries will feed into the knowledge base for next-generation nuclear reactors, will help us understand the behaviour of advanced materials under extreme conditions, and will train personnel for the nuclear industry.

TRIUMF serves as a key broker for Canada in global research in particle, nuclear, and accelerator physics. In addition to its core research programs, TRIUMF provides the scientific and technical staff needed to support Canadian scientists and students performing experiments at international facilities, such as the LHC at CERN, in Geneva, Switzerland, and the J-PARC facility in Japan. In return, scientists come from abroad to TRIUMF and Canada to conduct experiments and share their research. These international collaborations engage Canadian scientists and allow Canadian industry to benefit from the rapid advances and progress made in research from all over the world. These collaborations include university groups, research organizations, and high-tech international industry. For instance, TRIUMF has just signed a Memorandum of Understanding with the Variable Energy Cyclotron Centre in India that aims to jointly develop next-generation accelerator technology with a company in Richmond, British Columbia.

People Advantage: Enabling and Equipping the Next Generation of Leaders

TRIUMF will contribute to the development of Canada's students and science and technology workforce in the following ways:

- Attract international scientists and students to work at TRIUMF;
- Enhance Asia-Pacific scientific personnel exchange;
- Create undergraduate and graduate student research opportunities;
- Establish initiatives to attract and retain talent from traditionally underrepresented communities;
- Increase the engagement of Canadian universities in the TRIUMF program; and
- Participate in international student research exchange.

TRIUMF attracts talent from around the globe to Canada: more than 500 top graduate students, post-doctoral fellows, and researchers perform research at TRIUMF each year. For example, TRIUMF has recently recruited two of the world's elite scientists from the United States and Germany to lead core programs at the laboratory. TRIUMF is a high-tech engine of employment and training. The laboratory is a common destination for graduating engineers and technicians because the challenging technical environment ensures competitive training. These highly skilled personnel then move on to successful careers in other sectors.

Entrepreneurial Advantage: Bridging the Academic and Commercial Sectors

TRIUMF will contribute to Canada's entrepreneurial competitiveness in the following ways:

- Double the economic impact from technology transfer and commercialization with partners such as Advanced Applied Physics Solutions, Inc. (AAPS);

- Forge new industrial partnerships related to TRIUMF's world-recognized leadership in medical-cyclotron design;
- Establish a major new partnership with India in accelerator science;
- Connect radiotracer know-how with drug-development activities at the major pharmaceutical companies; and
- Establish a new partnership with MDS Nordion in radiotracer development.

The TRIUMF science research program serves as a springboard for developing innovations that lead to the commercialization of research. A number of Canadian companies, MDS Nordion, D-Pace, PAVAC Industries, ACS, and AAPS, have benefited from the expertise TRIUMF has developed. For instance, the BC-based company D-Pace was started after Dr. Morgan Dehnel graduated with his Ph.D. based on work at TRIUMF. D-Pace now licenses TRIUMF-developed technologies and has contracted to provide a dozen high-value ion sources to Japan. This partnership won national recognition in 2007 with the NSERC Synergy Award. TRIUMF's "nose" for good business also led to a renewal of its highly successful, 30-year-old relationship with MDS Nordion and a second Synergy Award. The TRIUMF/MDS Nordion partnership for the production and sales of accelerator-based medical isotopes generates more than \$25-\$30 million of private revenue each year. The next generation of business deals, commercialization agreements, and innovations is at hand.

The impact of TRIUMF's activities on the economy of Canada is quite broad. In terms of direct impact, the high degree of leveraging applied to the public investments is impressive. TRIUMF's 5-year accumulated economic impact, exceeding more than \$500 million in 2005–2010, is projected to double to more than \$1 billion in the next five years.

Request

The mechanism for supporting TRIUMF's five-year operating budget has been well established; a Memorandum to Cabinet is introduced by Industry Canada and the recommendations are folded into the federal budget by the Department of Finance. TRIUMF's request for 2010-2015 operating funds is \$328 million, of which \$23 million has already been secured through an award from the Canada Foundation for Innovation (CFI), leaving a net request of \$305 million. This request represents a 38% increase over the present five-year cycle of investment of \$222 million (not including about \$28 million of investment from previous CFI awards).

In support of the five-year vision for TRIUMF is an associated capital infrastructure request of \$60.7 million. This request is under consideration by the Province of British Columbia; mechanisms for cost-sharing with the federal government are being explored.

We hope you and your colleagues see as bright a future for Canada and TRIUMF as we do.

Sincerely,



Nigel S. Lockyer
Director



Timothy I. Meyer
Head, Strategic Planning & Communications